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First X-ray and Gamma-ray measurements at FACET-II

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The upgraded Facility for Advanced Accelerator Experimental Tests (FACET-II) at SLAC has started delivering the first electron beams for the initial phase of several experimental campaigns hosted at the facility. During these first runs, the users have been able to test and commission different elements of their set-up, but also to obtain preliminary data to characterise the experimental conditions. For most of these experiments, the X-ray and gamma radiation detectors installed at the end of the FACET-II beam line have provided a very useful insight of the different beam-plasma and beam-laser interactions. In this talk we will present the initial design, commissioning phase, and first preliminary data of the X-ray and gamma radiation diagnostics taken during these initial runs.

This presentation will cover the use of these detectors in the context of three different experiments. First, the E300 (PWFA) experiment~[C. Joshi \emph{et al.}, Plasma Phys. Control. Fusion 60, 034001 (2018)] will rely on these detectors to measure the matching dynamics of the accelerated trailing beam in the plasma~[P. San Miguel Claveria \emph{et al.}, Phil. Trans. R. Soc. A 377, 20180173 (2019)]. During the initial runs, a beam-ionised H_2 plasma of several meters of length was used to produce betatron radiation and measure it with the detectors, enabling the characterisation of the spatial and spectral distribution of the radiation at different plasma densities. This, together with the comparison of the data taken at FACET-I, confirms the physical basis of the working principle of the detectors. Similarly, in the context of the E305 experiment (Beam filamentation and bright gamma-ray bursts) the radiation produced in the beam-plasma interaction using a laser-ionised high density plasma has been measured at different gas-jet backing pressures. Finally, preliminary measurements of the bremsstrahlung radiation emitted in the interaction of the electron beam with solid foils and inverse-Compton radiation emitted in the beam-laser collision (E320, Strong-Field QED experiment) will be presented.

Acknowledgments

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